**Learning Activity Four:**

**Exploring Properties of Sound**

**Description of the Activity:**

Students will learn about the properties of sound energy in this lesson. They will investigate how to create sounds and explore how sounds are produced with vibrations. The inquiry approach will be utilized in this lesson with students exploring a question about how to produce different amounts of sounds based on the materials they are presented with for the lesson. Students will be engaged at the beginning of the lesson through videos from the internet on youtube.com and brainpop.com. Students will explore objects that produce sounds including a tuning fork in water causing the water to ripple, sand bouncing on a drum, and rice vibrating on a speaker. At the conclusion of their experimentations they will define vibrations. In order to assess student work in this lesson and to extend students work as “scientists” students will e-mail their experiment reports to students in another class with the intention for that class to replicate their experiment and results. Students will also record reflections about their experiences onto a classroom science blog as homework.

This activity is the fourth lesson in a five lesson unit on light and sound as forms of energy for a third grade science class. This lesson explores the properties of sound by challenging students to experiment with and investigate sound. The lesson will use a type of inquiry method of teaching science called the five “E” learning model of inquiry teaching. Technology will be integrated into the lesson in order to enhance the learning and exploration of the concepts of the lesson. Technology integrated into this lesson includes: a video on sound from brainpop.com, school account e-mail addresses and the use of a classroom science blog for reflection and review.

For this lesson, students will be working in groups of 3 to 4 students each. Students will use classroom computers and the lesson will take place inside the classroom. Students will have access to computers with internet, flashlights, and a digital projector. Students will also need to be able to type their reflection question into our classroom science blog either on computers at home or in the classroom.

Students will already need to know how to use basic functions of a computer such as turning it on and how to access the internet. Students will need to understand the concepts of being online and typing. Students will need to use program features such as using a mouse over text, toolbars, basic program menus, and basic typing. Students will also need to already know how to information onto a word processing document. The teacher will attach the word processing document to a classroom e-mail document to send to a different classroom in the school. The teacher will e-mail the document as part of a whole group activity. For using the classroom science blog, students will already need to know how to access and submit information to the science blog. This will be introduced earlier in the year during a class lesson on using the blog. This will not be the students first time accessing the science blog. Students will also need basic keyboarding skills for typing their reflections into the blog.

**Learning Objective:**

Learner Population: This lesson is intended for 3rd to 4th grade students. It will take place over a one hour science class sessions.

I will be teaching this lesson to a classroom of multi-aged mixed ability students made up of third and fourth graders. I will teach a population of 43 students this lesson. However, I will work with 2 groups of about 20 students at one time. I will teach one group of students this lesson for one class sessions, then the other group of 20 students the lesson on separate days.

Standards and benchmarks addressed: For this lesson I am addressing numerous state of Michigan Grade Level Content Expectations for third grade science. I am also addressing several National Technology Standards for K-12 students.

Goals and Objectives: students will…

* Identify and define sound as energy
* Relate sound to their sources of vibrations
* Create a lab report and experiment using our classroom established scientific method
* Communicate their experiment and results to a group of peers

**Technology Integration:**

The technology integrated into this lesson enhances the learning process for students in many ways. During the engagement portion of the lesson, students will watch a video on sound from brainpop.com titled, “sound.” The video will set up the content of the lesson and focus the student group explorations on the content of the lesson. During the exploration portion of the lesson, a speaker and music file will be used for students to identify vibrations and sound effects on objects such as rice. The “extend and apply” portion of the lesson will integrate the use of a classroom blog for student reflection. The blog allows a safe place for students to respond fully to a reflection question about the lesson and their learning. Doing the blog outside of the lesson allows for the students to have the time necessary to respond fully. The final piece of technology integration will be the use of e-mailing student typed experiments and results to another classroom with the intent of the students in that class replicating what students in my class explored. This integration will enhance learning because it will demonstrate to students that scientists must follow a scientific method so that other scientists can replicate their experiment and receive the same results. The students in the other classroom at our school will be asked to read through the experiment and attempt to replicate what was done and gain the same results.

The technology being integrated into this lesson fits nicely within the engagement, exploration, and extend sections of the five “E” learning model of inquiry teaching being used in this lesson. The only change in the instructional process for me is gathering the materials needed and testing out the videos before lesson.

**Connection to Standards:**

* State of Michigan Standards and Benchmarks: 3rd Grade Science

***K-7 Standard S.IP:*** *Develop an understanding that scientific inquiry and reasoning involves observing, questioning, investigating, recording, and developing solutions to problems.*

**S.IP.E.1 Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.**

***K-7 Standard S.IA:*** *Develop an understanding that scientific inquiry and investigations require analysis and communication of findings, using appropriate technology.*

**S.IA.E.1 Inquiry includes an analysis and presentation of findings**

**that lead to future questions, research, and investigations. S.IA.03.12** Share ideas about science through purposeful conversation incollaborative groups.

**Energy**

***K-7 Standard P.EN:*** *Develop an understanding that there are many forms of energy (such as heat, light, sound, and electrical) and that energy is transferable by convection, conduction, or*

*radiation. Understand energy can be in motion, called kinetic; or it can be stored, called potential. Develop an understanding that as temperature increases, more energy is added to a system. Understand nuclear reactions in the sun produce light and heat for the Earth.*

**P.EN.E.1 Forms of Energy- Heat, electricity, light, and sound are forms of energy.**

**P.EN.03.11** Identify light and sound as forms of energy.

**P.EN.E.3 Sound- Vibrating objects produce sound. The pitch of sound varies by changing the rate of vibration.**

**P.EN.03.31** Relate sounds to their sources of vibrations (for example: a musical note produced by a vibrating guitar string, the sounds of a drum made by the vibrating drum head).

**B: National Educational Technology Standards for K-12 Students**

1. Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

c. Use models and simulations to explore complex systems and issues

2. Communication and Collaboration

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital

environments and media.

b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats

3. Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information.

a. Plan strategies to guide inquiry

b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media

c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks

d. Process data and report results

4. Critical Thinking, Problem Solving, and Decision Making

Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

**Student Prior Knowledge:**

Prior to this lesson and at the beginning of this unit, students will be pre-assessed on light and sound as forms of energy. For this particular lesson, student prior knowledge will be assessed through a KWL chart that will be filled in through a class discussion at the start of the lesson. The KWL chart will be filled out by the entire class at once and will give a quick assessment to what students already know about sound as energy, and what they wish to learn. Based on their work in lesson one, students will have some knowledge of sound as a form of energy. They will have little knowledge on vibrations. Students will not need knowledge on sound and vibrations in order to be successful in this lesson. Students will need prior knowledge on using the classroom blog in order to have success in this lesson. However this will not be the first time students will use the blog in our lessons. Students who struggle with using the blog outside of the classroom can work on it in the classroom after the lesson and be supported by the teacher.

**Content Knowledge:** Sound and Vibrations

For this lesson, teachers will need knowledge on sound as a form of energy. Teachers will need knowledge on vibrations. Teachers should know how to relate sounds to their sources of vibrations (for example: a musical note produced by plucking a guitar string, the sounds of a drum made by striking a drumhead). For this lesson, relate means to establish an association or connection between sounds and their sources of vibration. Content knowledge that teachers need to know include; vibrating objects produces sound waves, sound vibrations are transmitted to anything the vibrating object touches, sound cannot travel through outer space where there is no air (matter), but light can travel through outer space. Other knowledge includes that sound waves travel out in every direction from a source, and when a guitar string is plucked, the vibrating string pushes against the adjacent air molecules causing them to vibrate. The air molecules push against neighboring air molecules until the vibrating air molecules reach a receiver such as an eardrum. Vibrations cause sound waves from a source such as guitar string or a drumhead. Some common misconceptions that teachers should be aware of include; sound cannot travel through solids and liquids, sound can travel through a vacuum, such as space, sound can be produced without using any materials, and hitting an object harder changes the pitch of the sound produced.

Teachers should also have knowledge and be able to explain some real world context to the content of sound and vibrations. The properties of sound are experienced in everyday life both at school and at home. Students hear natural and manufactured sounds every day through activities they do at school and home including playing and learning times. Natural sounds are sounds in nature and help scientists and naturalists identify species of animals. Animals identify one another through different sounds they make. People and other animals communicate using sounds. Sounds are used as warning signals in nature and society. The use of alarms and sirens are lifesaving sounds. Musicians use the properties of sound to create pieces of music. The vibrations of different instruments are blended to create music.

I personally possess all content knowledge necessary to lead this lesson with students. My content knowledge has been obtained through study through science units of light and sound in college, studying benchmarks and content expectations, reading science text books on light and shadows, and through experiences teaching shadow content in the past to students at this age.

**Pedagogical Knowledge:** Inquiry Method of Teaching Science

This lesson will use an adapted form of the inquiry method for teaching science following a “Five E” model of inquiry teaching. Students will be guided through structured explorations and discussions in order to form new learning concepts. The method of inquiry for this lesson will follow this format:

Engage: This section will begin the lesson. Students will first have a class discussion using a KWL chart on sound. This will help the teacher know any misconceptions students have. Students will then be engaged by watching a video titled, “sound” from brainpop.com. This video will set the stage for the lessons work and exploration. Teacher will tell students that they will be exploring properties of sound and that they will define vibrations during their work.

Exploration: This portion of the lesson will be where students explore properties of sound and create an experiment that attempts to define vibrations. The exploration question for this lesson is, “What causes these items (water, rice, sand) to move?” Students will also be challenged to create a definition of vibration while conducting their experiments. Student groups will be guided to different stations that have the water and tuning fork, the sound file, speaker and rice, and the drum and sand. Students will experiment and explore with these materials. Each group will rotate through each exploration section.

Explain: Teacher will call the class together and each group will clean up materials. Teacher will lead a class discussion and explain the content of the lesson to students through a guided discussion. Each group will present their findings and results and identify their working definition of vibrations. Teacher will record each group’s definition toward the class working definition.

Extend and Apply: This portion will contain the use of the classroom blog. As part of their homework, students will reflect on their learning and understanding of sound and vibrations. The reflection question for this lesson will have students reflecting and listing sound sources they identify at their home environment.

Evaluate: Students will be evaluated on their definition of vibrations and through the completion of their experiment report. The experiment report will be typed into a word processor. The teacher will then lead a class demonstration where they e-mail each groups experiment report to another classroom in the school. That classroom will replicate the experiments conducted by the groups. The teacher will save each word document to their computer then e-mail the documents using their school e-mail account to another teacher’s e-mail account. Teacher will do this through the use of a digital projector in order for students to see and take part in the e-mailing.

**Technology Knowledge:**

Teachers will need to know how to access computers and videos from the internet. Teachers will need to know how to access and maintain a classroom blog on edublogs.com. Teachers will also need to know how to guide students through typing of their experiment reports on word processor, save each file, then attach each file onto an e-mail. Teachers will need to know how to send e-mails and attach files. A school e-mail address would be suggested for the teacher for this lesson.

I personally have all technology knowledge needed for success in this lesson. I gained this knowledge through my work on my master’s degree program and my experiences teaching with blogs and by using digital projectors.

**TPACK Analysis:**

After choosing the content of sound, vibrations and their properties, an inquiry based approach to teaching was selected as an effective and acceptable method to teach this content. My undergraduate training at the University of Michigan Dearborn taught me the five “E” teaching model of inquiry based learning. I actually taught a light lesson using this method to a younger group of students during my time as an undergraduate student at U of M-Dearborn. These experiences taught me that an inquiry based approach is effective when teaching a lesson on light energy. The technologies selected to integrate into this lesson are effective in enhancing student learning of the content and fit in well with the inquiry method of teaching. I feel that the video will help to effectively engage students and set the “tone” of the lesson. I feel that the use of the blog is a great way for students to reflect about their learning because it allows for students to have time to think about what they have done. The blog is also effective because all students can see each other’s ideas. The alternative to the blog is a written science journal. I don’t like these journals because students could lose these and it is more challenging to share with the journals. With the blog any student can access the blog at home or at school and easily read and respond to their peers. The e-mailing is a great integration of the concept of what real scientists do. Once students complete their lab reports, they must e-mail their findings and reports to other students in other classes. This will demonstrate to students that they need to be precise when writing their experiment reports. I feel that the technology integrated in this lesson fits well with the content of sound and fits well with the inquiry method of teaching science.

**Assessment Plan:**

Students will be assessed based on the completion of their experiment reports and the working definition of vibrations. If their experiment report is typed correctly and their definitions fit with the content, then they have completed the objectives. For the writing of the lab reports the classroom scientific method will be used. Students will be graded based on the rubric below. Students must complete their experiment report and type it into a word processing program in order for it to be e-mailed to peers in another class.

**Sound Experiment Report:**

1. State Problem and Exploration Question:
2. Hypothesis:
3. Materials:
4. Experiment Procedures:
5. Results of Experiment:
6. Conclusion:

**Scoring Rubric:**

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| --- | --- | --- | --- |
| Components: | Advanced:  3 | Meeting Expectations: 2 | Below Expectations:  1 |
| Problem | Problem is connected to real world context that extends beyond the class stated problem and question. | Classroom discussed problem is clearly stated in lab report as well as the exploration question. | Missing either the class discussed problem or question and or not clearly stated. |
| Hypothesis | Hypothesis clearly stated with rationale and support as to why it was chosen. | Hypothesis clearly stated. | Hypothesis not stated or includes misinterpretations of the content. |
| Materials | All materials clearly stated. Sketches or diagrams of materials included. | All materials needed to complete the experiment procedure are clearly stated. | Missing some materials needed to complete the experiment procedure. |
| Experiment Procedure | All steps needed to successfully complete the experiment clearly stated. Includes diagrams pictures or drawings where needed. May also include specific measurement data needed. | All steps needed to successfully complete the experiment clearly stated. | Missing steps needed to successfully complete the experiment. |
| Results | Results clearly stated with supporting evidence or rationale for why these results occurred. | Results clearly stated. | Results not complete or clearly stated. |
| Conclusion | Conclusion stated that includes a complete analysis of the problem statement and analysis of hypothesis. Real world context is connected and explained. | Conclusion is clearly stated with supported rationale or evidence given. | Conclusion may include misconception or misinterpretation. No supporting detail included. |